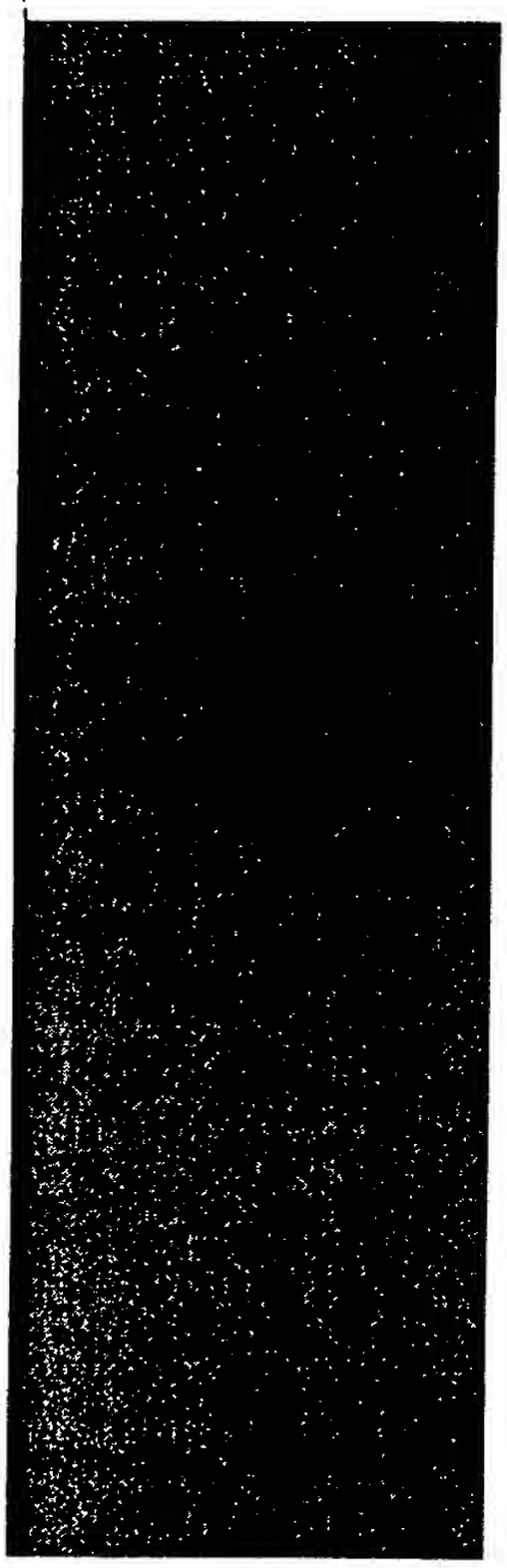


Digital Video : UpConvertor

The UPCONVERTER integrated circuit provides ;
High Resolution, High Quality Video Display
without a High Definition Signal or extensive Investment

- More than a line doublerà, the UpConverter uses a combination of functions to increase the number of lines, remove interlacing, enhance pixelization through spatial and temporal interpolation, and increases the frame rate
- Enables users with high resolution television sets or computer monitors to view high definition video with low resolution input
- Broadcasters can provide HDTV-like services without using the precious bandwidth
- May reside in the set top boxes, monitors or stand alone boxes

Typical Applications

- High Definition Digital TV
- Home Theater
- Video on PC

Features

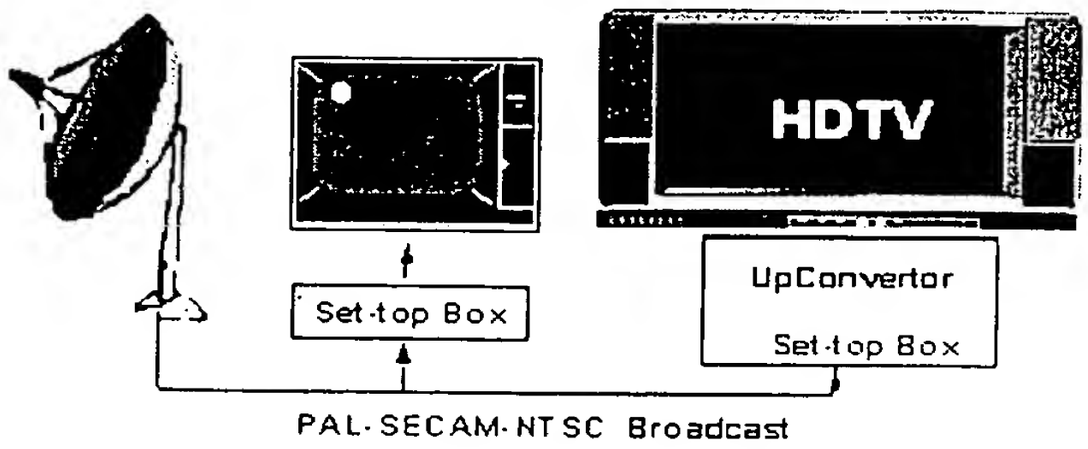
- Flicker reduction and scan line removal for large displays:

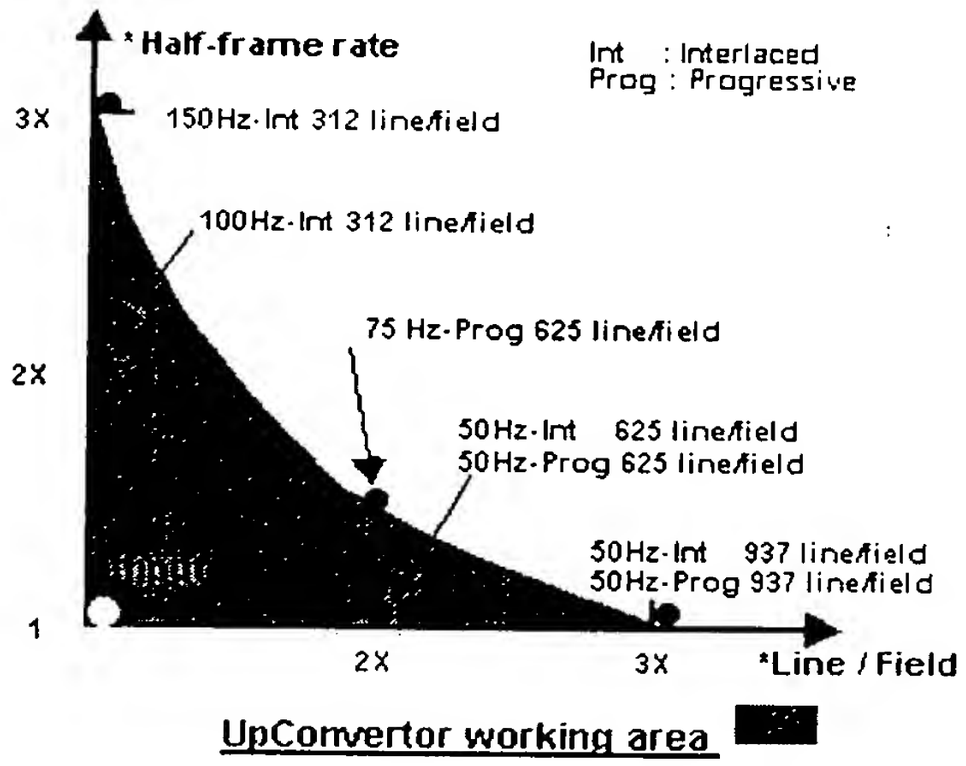
APPENDIX

U.S. PATENT APPLICATION ENTITLED
"VIDEO DISTRIBUTION SYSTEM"
FILED: SEPTEMBER 28, 2000
INVENTORS: CHARLES ERIC HUNTER, ET. AL.
ATTORNEY DOCKET NO: WT-10

- Progressive scan conversion
- Increasing field rate
- 525/625 line input conversion to range of lines and display rates

- Aspect Ratio Control:
  - Standard video on widescreen displays
  - Widescreen video on standard displays
  - Fully flexible zoom and shrink capability
  - Picture windowing and clipping control
- TV signals /PC graphics seamless mix
  - PC graphics on TV, TV Video on PC
  - Electronic 'Multi-sync





- **Technical Summary**

- **Development kit**

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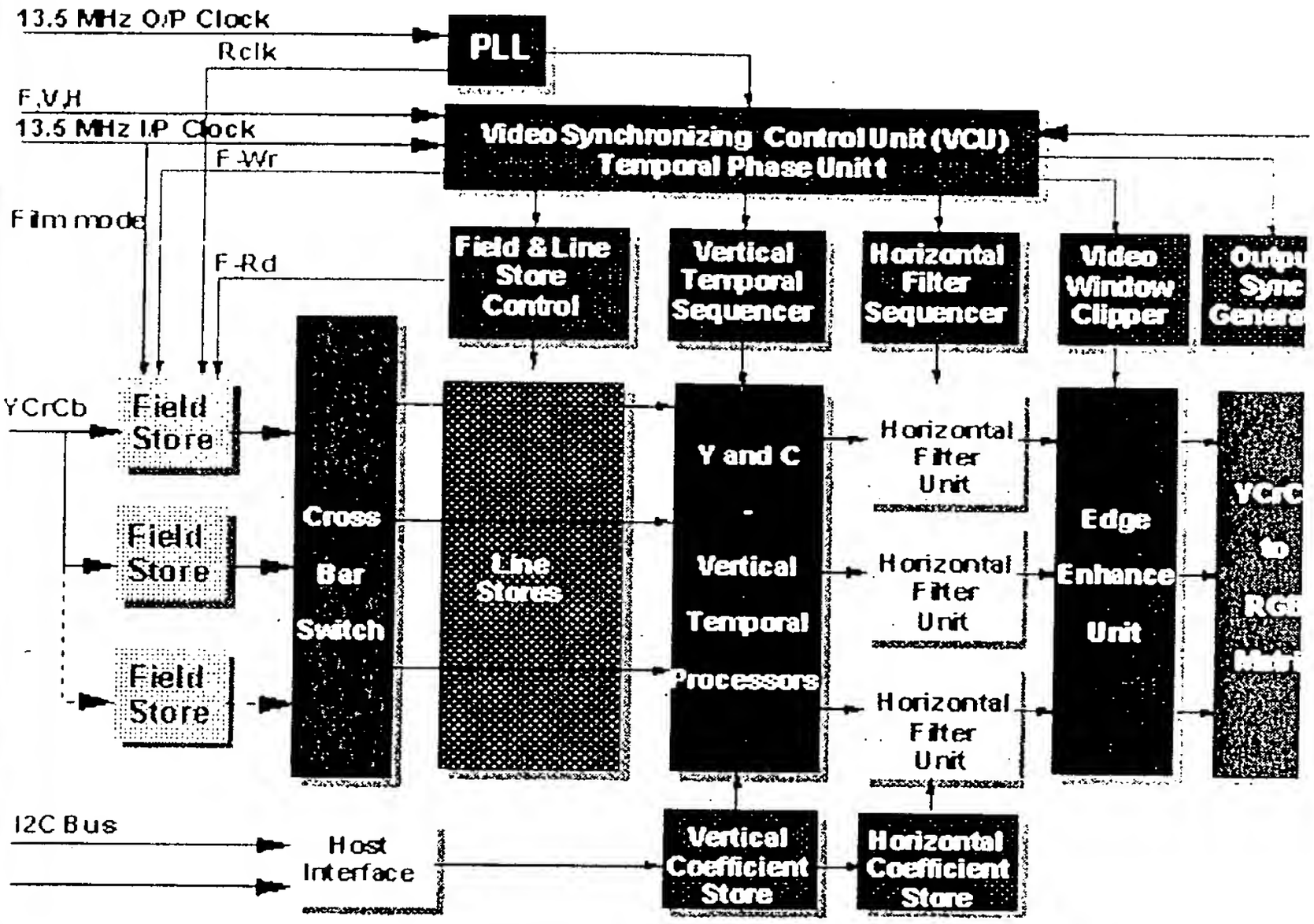
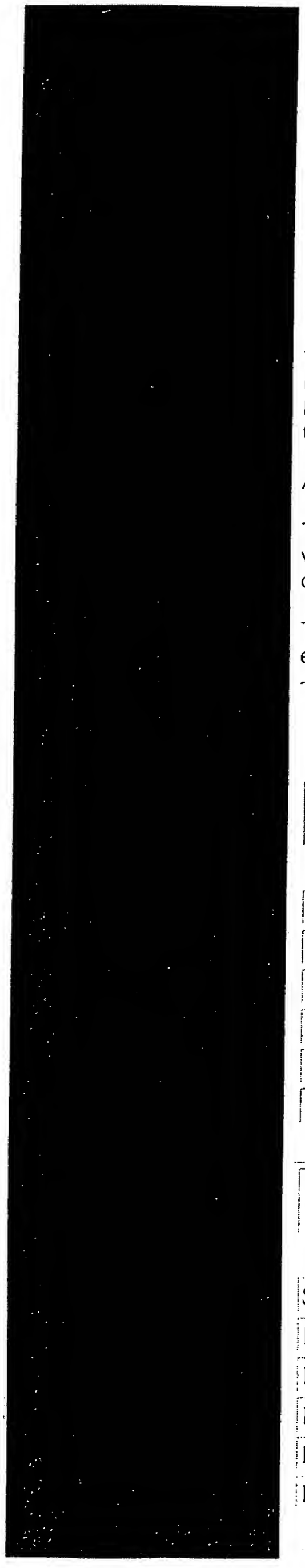
Updated Aril 21,99

MULTIMEDIA VIDEO UPCONVERT



Features

- Fully temporally filtered de-interlacing
- Resolution independent operation
- Frame & line rate convertor to 3X
- 8b Y,Cr,Cb inputs, 4:1:1 or 4:2:2
- Multiple 8b output format:
  - RGB 4:4:4
  - YCrCb 4:4:4 or 4:2:2
- Edge sharpness enhancement
- Film mode processing
- Flexible picture sizing, windowing , clipping and positioning
- Independent H and V expand and shrink
- Output synchronizable to external locking
- Fast 8b port or I2C bus host interface
- Technology
  - 0.5µm 3.3Volts CMOS
  - 1.2 Watt Nominal
  - 28mm, 208 pins CQFP



Product Description

The SWHD1 utilises the Snell & Wilcox® 3-dimensional spatial/temporal interpolation an technology to perform real time de-interlacing and frame rate upconversion of digital vide unsurpassed quality and flicker reduction. It is fully compatible with PAL, SECAM and NT MPEG-2 frame rates in either widescreen or standard formats for input or output.

The SWHD1 performs real time up-conversion of an incoming video stream and outputs video pixel stream at up to 3 times the input rate. This rate is achieved by de-interlacing fields and changing the field rate via a vertical/temporal interpolator.

The 3D interpolation image processing technology is used to provide the highest quality using information from 3 input fields to generate each output field. A second stage filter p horizontal filtering for high quality display of widescreen (16:9) input images on a standar television set.

A lower cost system option uses only 2 input field stores.

The SWHD1 provides user selectable shrink and zoom via high quality interpolation of th video. Additionally an arbitrary display window can be defined to isolate the required port displayed video. An edge enhancement function can also be applied to the video stream

The output timing is fully asynchronous with the input, so may be locked to an external s example a computer data display.

Display Conversion Examples

PAL/SECAM (625)

	Input	-----Output-----						
Scan Rate(Khz)	15.62	31.25	31.25	31.46	35.16	39.40	46.87	46.77
Pixels/Line	720	720	720	640	960	640	720	800
Field Rate(Hz)	50	100	75	60	75	75	75	75
Format	int	int	int	NI	int	NI	NI	NI
Lines.Field	312.5	312.5	416	525	468	525	625	625
Pixel Rate (Mhz)	13.5	27	27	24	40.5	30.2	40.5	40.5
		100Hz		VGA		VGA		SVGA

NTSC (525)

	Input	-----Output-----						
Scan Rate(Khz)	15.73	31.46	31.46	31.46	35.84	47.24	47.24	48.09
Pixels/Line	720	720	720	640	960	640	720	800
Field Rate(Hz)	60	60	60	60	75	90	90	72
Format	int	int	int	NI	int	NI	NI	NI
Lines.Field	262.5	525	370	525	468	525	525	667
Pixel Rate (Mhz)	13.5	27	27	24	40.5	36.3	40.5	40.5
		2xlines		VGA		VGA		SVGA

[redacted]

Memory Requirements:

For full system functionality, including noise reduction, the SWHD1 interfaces with 3 stan VRAMs via the IBM SWMC1 memory controller (IBM39 ESSWMC1 CFA 40 C). The SW supports direct interface to industry standard Field Stores.

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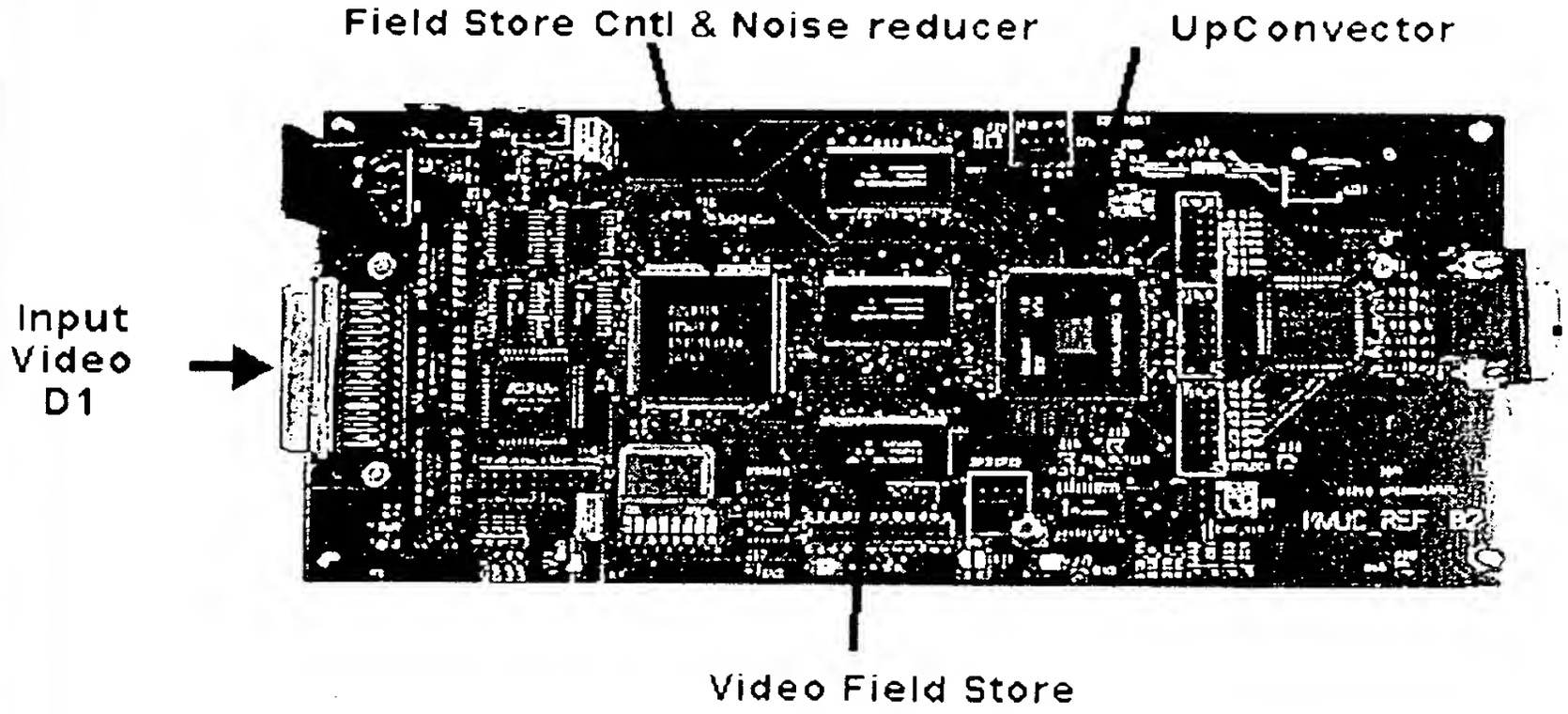
VUC-REFB2 : UpConvertor des kit

Development kit includes ;

- UpConverter chip and applicable associated devices as required
- Field store support & noise reducer



The Upconverter Chip Key Features and Specifications

- Upconverter functionality in a single IC*, full operational model on single board û works in conjunction with applicable signal conversion devices such as A/D and D MPEG-2 converters (additional devices may be required)
- Fully spatially and temporally filtered de-interlacing
- Resolution independent operation
- Frame rate conversion to up to 3X (no flicker or twitter)
- Line rate converter up to 3X (up to 1875 lines (max at PAL))
- 8b Y, Cr, Cb 4:2:2 inputs, multiple 8b output format: RGB 4:4:4, YcrCb 4:4:4
- High resolution quality filtering
- Accurate vertical/temporal interpolation and horizontal interpolation
- Edge sharpness enhancement processing
- Flexible windowing and picture positioning
- Independent X and Y expand and shrink (zoom up to 16X or shrink to 1/16th)
- Flexible host interface (fast 8b port or 12C bus)
- Aspect ratio and picture flexibility and control (windowing, scaling, clipping and po 16:9) û independent X, Y, offset, and cropping
- Accurate picture resizing
- Film mode processing
- Output synchronizable to external locking
- Open to virtually any input standard selection Upconverter can triple the number o respect to the number of line/input field (assuming no change in the number of pix frame rate).

  For example, NTSC has 262.5 lines/field (or 525/frame), and the Upconverter c

[redacted]

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785.5 lines/field (or 1575/frame) if the output is interlaced, or 787 line/frame if the progressive (in that case, the frame is the same as the field. The same approach PAL.

* Please Note: Additional devices required may include the following (non-exclusive): An and digital to analog converters, MPEG-2 decoder, digital converter (such as Phillips 711 line-standard controller chip with display; associated connectors and boards.

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